GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Finite element method, PG_00042224		
Field of study	Civil Engineering		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	2	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Katedra Wytrzymałości Materiałów -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Wojciech Witkowski	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	30.0	0.0	0.0	60

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	60	5.0	35.0	100

Subject objectives

Getting familiar with base of Finite Element Method in theory (lectures) and practice (laboratory classes). Working in two different computational environments - ABAQUS, SOFiSTiK.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W03] has knowledge of Continuum Mechanics, knows rules of static analysis, stability and dynamics of complex rod, shell and volume structures, both in linear and basic nonlinear regime		[SW1] Assessment of factual knowledge
[K7_W04] has knowledge on advanced strength of materials, modeling and optimisation of materials and constructions; has knowledge of fundamentals of Finite Element Method and general nonlinear analysis of engineering constructions and systems		[SW1] Assessment of factual knowledge
[K7_U06] is able to choose proper tools (measuring, analytical or numerical) to solve engineering problems, to acquire, filtrate, proces and analyse data		[SU1] Assessment of task fulfilment
[K7_U04] is able (using Finite Element Method), to define a calculation model and to perform advanced numerical analysis of complex constructions in: linear range and elementary nonlinear range, can criticaly evaluate the results of calculations.		[SU1] Assessment of task fulfilment

Subject contents	FEM Codes, commercial, own-developed. Application of numerical method in theory of structures. Strong and weak forms, mechanics of continuum. Variational calculus. Variational principles of mechanics. Ritz method. FEM as a special case of finite dimensional approximation. FE discretization, interpolation. Models of finite elements, classification. Displacement formulation, selected finite elements, isoparametric formulation. Standard stages of FEM solution. Selected topics in application of FEM, verification and interpretation of results
Prerequisites and co-requisites	BSP020 Structural mechanics BSP021 Computational methods BSP022 Computational analysis of structure

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Test	60.0%	30.0%
Laboratory test	60.0%	70.0%

Recommended reading

Basic literature	1. RAKOWSKI G., KACPRZYK Z.: Metoda elementów skończonych w mechanice konstrukcji. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005. 2. KLEIBER M (red).: Komputerowe metody mechaniki ciał stałych. Mechanika Techniczna t. XI. PWN, Warszawa 1995. 3. DACKO M., BORKOWSKI W., DOBROCIŃSKI S., NIEZGODA T., WIECZOREK M.: Metoda elementów skończonych w mechanice konstrukcji. Arkady Warszawa 1994. 4. ZIENKIEWICZ O.C.: Metoda elementów skończonych. Arkady 1972, lub nowsze wydania w języku angielskim.
Supplementary literature	1. CHRÓŚCIELEWSKI J., MAKOWSKI J., PIETRASZKIEWICZ W.: Statyka i dynamika powłok wielopłatowych. Nieliniowa teoria i metoda elementów skończonych. PAN IPPT, Biblioteka Mechaniki Stosowanej Serii A, monografie, Warszawa 2004. 2. KREJA I.: Mechanika Ośrodków Ciągłych. Wydawnictwo CURE, Politechnika Gdańska, Gdańsk 2003.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	1. What are the sources of nonlinearity in mechanics, give examples. 2. Why FEM is regarded as an approximation method? 3. Explain the notion: linear elastic material. 4. Write the expression for components of linear strain tensor. 5. Name the problems of the Ritz method? 6. Write the requirements that must be satisfied by shape functions. 7. Explain the term: rigid body motion. 8. Describe the possible disadvantages of using CST element. 9. Describe the possible undesired effects of reduced integration. 10. How do you understand locking effect?
Work placement	Not applicable

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